HIGH RESOLUTION 4.8 GHZ MAPPING OF $H_2CO$ USING THE WESTERBORK SYNTHESIS RADIO TELESCOPE

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## INTRODUCTION

We mapped the distribution of 6 cm $H_2CO$ ($1_{10} \rightarrow 1_{11}$) absorption against the HII regions DR21 and W58 with an angular resolution of 6".8 (RA) and a velocity resolution of 0.73 km $s^{-1}$. The Westerbork SRT was used with the newly completed 5120 channel digital line receiver. With all 14 telescopes, a maximum baseline of 1440 m, both linear polarizations and a bandwidth per channel of 10 kHz the rms noise in the channel maps was about 7 K. The goal of this work is to measure scale sizes of $H_2CO$ in molecular clouds near HII regions and to study the kinematics of the clouds in the molecular line.

## RESULTS

The $H_2CO$ optical depth profile in the direction of maximum intensity in DR21 (Fig. 1a) shows three features at velocities -4.5, -3.1 and 8.6 km $s^{-1}$. The intensities of the lines change markedly with position. At a distance of 2 kpc (Dickel et al. 1978) the linear extent of the background source is about 0.5 pc and the synthesized beam size is 0.1 pc (RA) by 0.15 pc (DEC). The optical depth distribution of the main feature at the peak of the line (-3.1 km $s^{-1}$) is mapped in Fig. 1b. The -4.5 km $s^{-1}$ feature is strongest along the western edge and the 8.6 km $s^{-1}$ feature appears inversely correlated with the main feature and is much weaker. The intensity weighted mean velocities of the -3.1 and 8.6 km $s^{-1}$ features vary by about 1.2 km $s^{-1}$ over the source and also appear to be inversely correlated. The linear scale for significant changes in optical depth is about 0.2 pc for all three features.

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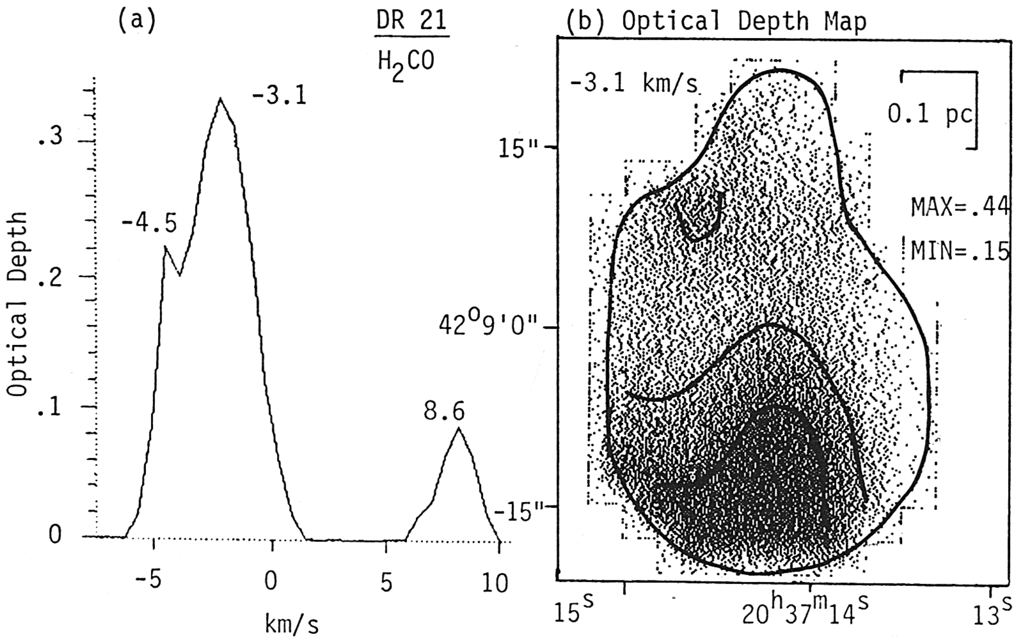


Figure 1. (a) $H_2CO$ optical depth profile at the position of maximum flux in DR 21. (b) Distribution of optical depth at -3.1 km/s. The contours are at optical depths of 0.3 and 0.4.

Optical depth profiles in the directions of components A (K3-50), B and C in W58 are given in Figure 2 along with a portion of the 6 cm continuum map of Israel (1975). The profiles are spatial averages over the individual components shown. Component C has a much larger $H_2CO$ opacity than the other two components and also shows strong variation between the two sub-components C1 and C2. The optical depths measured at the line center (-21.2 km $s^{-1}$) are listed below for four positions in W58.

| Radio Component | (1950) Position RA | DEC | Optical Depth at -21.2 km $s^{-1}$ |
|---|---|---|---|
| A(K3-50) | $19^h59^m50\overset{s}{.}1$ | 33°24'20" | 0.01 ± .01 |
| B | 51.9 | 24 40 | 0.06 ± .04 |
| C1 | 58.4 | 25 51 | 1.75 ± .01 |
| C2 | 59.6 | 25 51 | 0.13 ± .05 |

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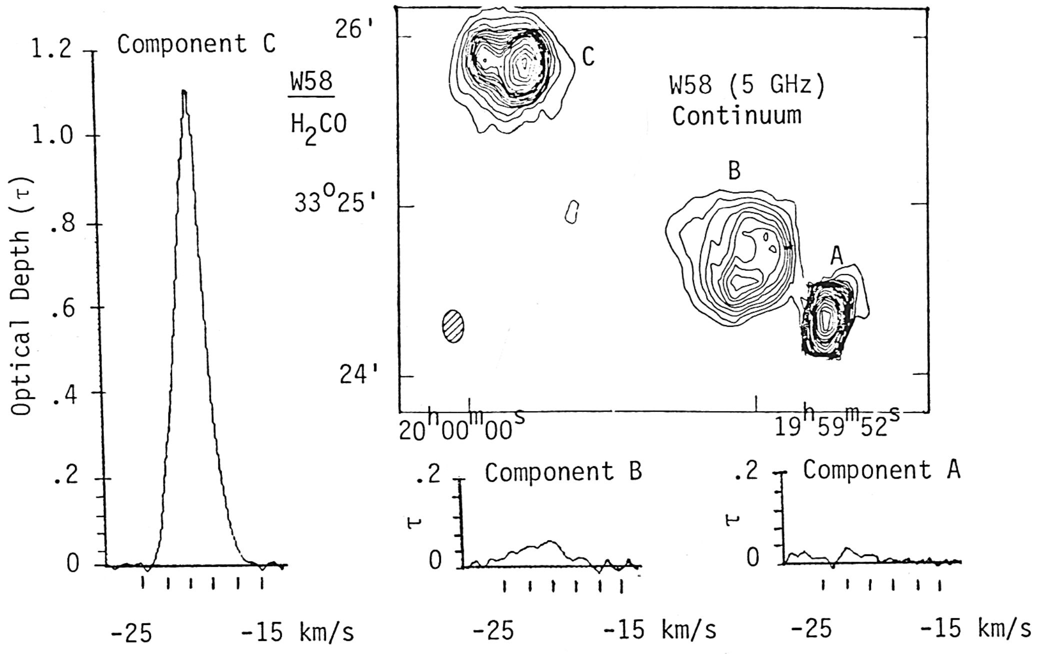


Figure 2. Spatially integrated optical depth profiles in the direction of components A, B and C in W58. The contimuum map is taken from Israel (1975).

The most striking aspect of the region is the dramatic change in $H_2CO$ opacity among the various components. This is not altogether unexpected as component A is associated with the optical object K3-50 and component C1 has several hundred magnitudes of visual extinction (Wynn-Williams et al. 1977) and the OH maser ON-3 is associated with it. At a distance of 9 kpc the linear size of the synthesized beam is 0.46 x 0.84 pc. The $H_2CO$ opacity in front of component C changes by more than a factor of 10 on an apparent linear scale of about a parsec.

Velocity structure is also observed in component C. The $H_2CO$ velocity field will be compared to recent H109α WSRT data obtained by van Gorkom et al. (in preparation) in order to help determine the geometry and kinematics of the region.

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DISCUSSION FOLLOWING FORSTER

*Goldsmith:* Is the variation in $H_2CO$ opacity due to changes in $H_2$ density or to changes in fractional abundance?

*Forster:* In W58, at least, the most deeply absorbed components are also optically obscured, suggesting that the $H_2CO$ variations are caused by density changes.

*Greenberg:* Do you have any way of establishing the exact location of the $H_2CO$ with respect to the HII region. Is it far or close, and can you discriminate between the velocity of the $H_2CO$ and the velocity of the HII region?

*Forster:* The $H_2CO$ agrees with the CO and other molecular line velocities, and so is assumed to lie within the associated molecular cloud. The velocities of the individual HII region components are given by the recombination line velocities measured with the Westerbork Synthesis Radio Telescope by van Gorkom et al. (in preparation).